

REMARKS

Claims 1-11 are pending in this application. Claim 11 has been added. The examiner has rejected claims 1-9 under 35 USC §112, second paragraph and 35 USC §103(a). In response to applicant's election with traverse the examiner has made the restriction requirement final.

**1. Response to Rejections based on 35 USC §112**

In response to the examiner's first rejection under 35 USC §112, applicants have amended claim 1 to specify a number average molecular weight. Support for this limitation may be found on page 6, lines 32-35. Applicants respectfully request the rejection be withdrawn.

In response to the examiner's second rejection under 35 USC §112, applicants provide the remarks below. The examiner argues that claims 1, 2 and 4-9 do not correspond in scope with that which applicants regard as the invention as outlined on page 7, lines 22-38. However, applicants respectfully assert that the examiner has not provided evidence to support a rejection under 35 USC §112, second paragraph, for failing to set forth the subject matter which applicants regard as their invention. Under MPEP §2172, a rejection based on the failure to satisfy this requirement is appropriate only where applicant has stated, somewhere other than in the application as filed, that the invention is something different from what is defined by the claims. Accordingly, the content of applicant's specification is not used as evidence that the scope of the claims is inconsistent with the subject matter which applicants regard as their invention. *In re*

*Ehrreich* 590 F.2d 902, 200 USPQ 504 (CCPA 1979), MPEP 2172.

In the Office Action dated September 6, 2002, the examiner specifically sites applicants specification page 7, lines 22-38 as evidence that the rejected claims do not correspond in scope with the instant disclosure. However, pursuant *In re Ehrreich*, the applicant's specification may not be used as evidence for a rejection for failure to set forth the subject matter that the applicant regards as the invention. Accordingly, applicants respectfully request the rejection be withdrawn.

Furthermore applicants have adequately described formula I in Claim 1 as an ether having R<sup>1</sup> and R<sup>2</sup> groups which are primary or secondary alkyl groups having 3-10 carbon atoms with at least one of the groups having a secondary alkyl group. Specific support for this may be found in the specification on page 7, lines 25-30.

*over look the limitation  
3-10 Carbon*

The examiner argues that an ether of formula CH<sub>3</sub>O CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>(CH<sub>3</sub>)<sub>2</sub> reads on the instant claimed ether. However, this ether does not read on claims 1,2 and 4-9 as they stand as it does not contain primary or secondary alkyl groups having 3-10 carbon atoms nor does the applicant describe the secondary alkyl ether as "-CH-(R)<sub>2</sub>". Specifically, the specification recites that formula I may be any ether in which the groups R<sup>1</sup> and R<sup>2</sup> are derived from a secondary alcohol and are primary or secondary alkyl groups having 3-10 carbon atoms. (Page 7, lines 28-31). Furthermore, applicants have described R<sup>2</sup> as methyl and ethyl at page 7, lines 35. This disclosure supports the newly added claim 11.

## **2. Response to Rejections based on 35 USC §103**

The examiner has rejected claims 1-9 as unpatentable over Rath (US 5,408,018)

(the '018 patent). However, as discussed below with regard to the specific references the examiner has failed to establish a *prima facie* case of obviousness with respect to the instant invention. Three requirements must be fulfilled in order for a *prima facie* case of obviousness to be satisfied. First, there must be some suggestion or motivation in the references themselves or available to one of ordinary skill in the art to modify the reference or to combine reference teachings.<sup>1</sup> Second, there must be a reasonable expectation of success. Third, the prior art references combined must teach or suggest all the claim limitations. MPEP §2143. Both the suggestion to carry out the claimed process and the reasonable expectation of success must be found in the prior art and not based on the applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991). Additionally, the level of ordinary skill in the art cannot be relied upon to provide the suggestion to combine references. *Al-Site Corp. v. VSI Int'l Inc.* 174 F.3d 1308, 50 USPQ2d 1161, 1171 (Fed. Cir. 1999). With respect to the instant application the examiner has failed to meet this burden.

In this instance, the examiner has failed to identify the motivation of one of skill in the art to modify the process of the '018 patent, nor does the reference meet every element of the claim. In the office action, the examiner identifies column 8, lines 37-42 as teaching that methyl isooctyl ether and isooctyl ether can be used in the trifluoride/secondary alcohol/dialkyl ether complex. However, this section of the disclosure requires at least one

---

<sup>1</sup>There are three possible sources for motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-1458 (Fed. Cir. 1998).

tertiary alkyl group (column 8, lines 30-35). The instant invention does not utilize an ether containing tertiary alkyl groups. Therefore, applicants respectfully assert that a *prima facie* case of obviousness has not been met and requests the rejection be withdrawn.

Furthermore, the invention of the instant application provides an unexpected improvement over that of the prior art. Proof of an unexpected improvement may rebut a *prima facie* case of obviousness. *In re Murch*, 464 F.2d 1051, 175 USPQ 89 (CCPA 1972). Indeed, it is always error to exclude evidence of secondary indicators. *Stratoflex v. Aeroquip Corp.*, 713 F.2d 1540, 218 USPQ 871 (Fed. Cir. 1983).

As outlined in the table below, applicants conducted a comparison of the process according to the instant invention and the process utilizing isopropyl tert-butyl ether. Example A as outlined in the table below corresponds to Example 7 of the instant application on page 13, lines 42-45 and in the table on page 14. The example A, corresponding to example 7 of the application was carried out as follows.

Applicants utilized a recycle reactor consisting of a Teflon tube which had a length of 7.1 m and an internal diameter of 6 mm via which 100 l/h of the reactor content were circulated by means of a gear pump. The tube and pump had a capacity of 200 ml. The Teflon tube and the pump head were immersed in a cooling bath having a temperature of -23.8°C (cryostat). A mixture of 300 g/h of isobutene and 300 g/h of hexane was dried over a 3Å molecule sieve to a water content of less than 3 ppm, and then fed to the recycle reactor through a capillary which had an internal diameter of 2 mm and which was pre-cooled to -23°C. BF<sub>3</sub> and isopropanyl/diisopropylether as complexing agents were

-13°C  
in Rath

directly introduced into the hexane feed to the reactor. The feed of 10 mmol/h isopropanol and 25 ml/h di-sec-butyl ether and n-hexane (as diluent) was set to 15:1:4, and the amount of  $\text{BF}_3$  was varied until a concentration of isobutene of 1% by weight was obtained.

At a reactor temperature of  $-18^\circ\text{C}$  the  $\text{BF}_3$  feed amounted to 21.4 mmol/h. The reactor effluent was washed with water and worked up by distillation at  $230^\circ\text{C}/2\text{mbar}$ . The molecular weight  $M_n$  of the polymer was 890, the reactivity (vinylidene double bond content) was 95.9%.

This process was repeated in the comparative example utilizing isopropyl tert-butyl ether instead of di-sec-butyl ether. To arrive at a molecular weight in the magnitude obtained in Example A, the amounts of  $\text{BF}_3$  and isopropanol had to be increased over Example A. Thus, as you can see from the results displayed in table form below, the instant process provides an unexpected increase in reactivity over that of the process utilizing isopropyl tert-butyl ether.

| Example                | $\text{BF}_3$<br>[mmol/h] | Isopropanol<br>[mmol/h] | Ether<br>[mmol/h]                         | Molar Ratios |         | [Isobutene]<br>weight % | $M_n$ | Reactivity<br>[%] |
|------------------------|---------------------------|-------------------------|---|--------------|---------|-------------------------|-------|-------------------|
|                        |                           |                         |   | B:I          | (I+B):S |                         |       |                   |
| A                      | 21.4                      | 10.0                    | 25.0<br>Di-sec-<br>butylether             | 2.5          | 1.64    | 1.0                     | 890   | 95.9              |
| comparative<br>example | 29.7                      | 15.0                    | 25.0<br>Isopropyl-<br>tert-<br>butylether | 2.5          | 1.36    | 1.0                     | 960   | 85.4              |

*not n-butyl-ether or  
n-butyl tert-butyl ether in Ex. 6-8 of Rath*

In light of these unexpected results applicants assert that any *prima facie* case of obviousness that may have been established has been overcome by the unexpected

Hans Peter Rath

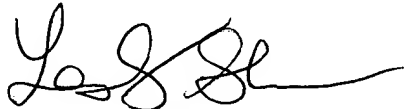
Serial No. 09/107,587

results provided by the applicants. Currently, applicants intend to file these results in affidavit form. Due to the time constraints of preparing and executing the affidavit applicants were not able to provide the affidavit with this submission. Thus applicants respectfully request consideration of these results by the examiner in this response. With the examiner's permission, the affidavit will be filed by supplemental response as soon as possible.

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees to Deposit Account No. 11-0345. Please credit any excess fees to such deposit account.

Respectfully submitted,

KEIL & WEINKAUF

A handwritten signature in black ink, appearing to read 'Lesley E. Shaw', followed by a long, sweeping horizontal line.

Lesley E. Shaw  
Reg. No. 52,214

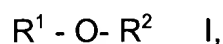
1350 Connecticut Ave., N.W.  
Washington, D.C. 20036  
(202)659-0100  
HBK/LES/mks

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

11.(Newly added)A process for preparing highly reactive polyisobutenes having a terminal vinylidene group content of more than 80 mol% and an average molecular weight of from 500 to 5000 dalton by cationic polymerization of isobutene in the liquid phase in the presence of a complex comprising boron trifluoride at from +40°C to -60°C, which comprises polymerizing in the presence of a complex comprising boron trifluoride and

a) a primary alcohol having 1-20 carbon atoms or a secondary alcohol having 3-20 carbon atoms, or a mixture of these alcohols, and

b) an ether containing no tertiary alkyl groups and having the formula I



where R<sup>1</sup> and R<sup>2</sup> are primary or secondary alkyl groups having 3-10 carbon atoms, with the proviso that at least one of R<sup>1</sup> and R<sup>2</sup> is a secondary alkyl group, or R<sup>2</sup> is methyl or ethyl.

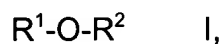
**COPY OF ALL CLAIMS**

1. A process for preparing highly reactive polyisobutenes having a terminal vinylidene group content of more than 80 mol% and an average molecular weight of from 500 to 5000 dalton by cationic polymerization of isobutene in the liquid phase in the presence of a complex comprising boron trifluoride at from +40°C to -60°C, which comprises polymerizing in the presence of a complex comprising boron trifluoride and
  - a) a primary alcohol having 1-20 carbon atoms or a secondary alcohol having 3-20 carbon atoms, or a mixture of these alcohols, and
  - b) an ether containing no tertiary alkyl groups and having the formula I
$$R^1-O-R^2 \quad I,$$
where  $R^1$  and  $R^2$  are primary or secondary alkyl groups having 3-10 carbon atoms, with the proviso that at least one of  $R^1$  and  $R^2$  is a secondary alkyl group.
2. A process as claimed in claim 1, wherein the secondary alcohol a) used is isopropyl alcohol and/or 2-butanol.
3. A process as claimed in claim 1, wherein the ether b) used is diisopropyl ether, di-sec-butyl ether and/or isopropyl sec-butyl ether.
4. A process as claimed in claim 1, wherein the primary and/or secondary alcohol a) and the ether b) are used in a molar ratio of from 0.01:1 to 10:1.
5. A process as claimed in claim 1, wherein the primary and/or secondary alcohol a) and the ether b) are used in a molar ratio of from 0.02:1 to 2:1.



6. A process as claimed in claim 1, wherein boron trifluoride, primary and/or secondary alcohol and ether are combined in the polymerization reactor to generate the complex in situ in the polymerization mixture.
7. A process as claimed in claim 1, wherein the boron trifluoride/ether complex is preformulated and is introduced, together with the primary and/or secondary alcohol or separately, into the solvent or monomer feed to the reactor or directly into the reactor.
8. A process as claimed in claim 1, wherein polyisobutenes having a terminal vinylidene group content of more than 90 mol% are polymerized at an isobutene conversion of up to 95% using a preformed boron trifluoride/isopropanol/diisopropyl ether complex, a molar secondary alcohol/ether ratio of from 2:1 to 1:5 and a boron trifluoride/diisopropyl ether ratio of from 0.6:1 to 0.9:1.
9. A process as claimed in claim 1, wherein the isobutene source is a C<sub>4</sub> cut comprising isobutene in an amount of at least 6% by weight.
10. A polyisobutene having an average molecular weight of from 500 to 5000 dalton and a terminal vinylidene group content of more than 90%, obtainable by cationic polymerization of isobutene in the liquid phase with the aid of boron trifluoride as catalyst at from 40 to -60°C in the presence of a boron trifluoride complex with
  - a) a primary alcohol having 1-20 carbon atoms or a secondary alcohol having 3-20 carbon atoms, or a mixture of these alcohols, and

- b) an ether containing no tertiary alkyl groups and having the formula I



where  $R^1$  and  $R^2$  are primary or secondary alkyl groups having 3-10 carbon atoms, with the proviso that at least one of the radicals  $R^1$  and  $R^2$  is a secondary alkyl group.

11. A process for preparing highly reactive polyisobutenes having a terminal vinylidene group content of more than 80 mol% and an average molecular weight of from 500 to 5000 dalton by cationic polymerization of isobutene in the liquid phase in the presence of a complex comprising boron trifluoride at from +40°C to -60°C, which comprises polymerizing in the presence of a complex comprising boron trifluoride and

- a) a primary alcohol having 1-20 carbon atoms or a secondary alcohol having 3-20 carbon atoms, or a mixture of these alcohols, and
- b) an ether containing no tertiary alkyl groups and having the formula I



where  $R^1$  and  $R^2$  are primary or secondary alkyl groups having 3-10 carbon atoms, with the proviso that at least one of  $R^1$  and  $R^2$  is a secondary alkyl group, or  $R^2$  is methyl or ethyl.